ESS Naming Convention

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SSSS-BBBB:DDDD-III:TTTIIIXXX

Device Name

Signal Name

SSSS	System
BBBB	Subsystem
DDDD	Device Identifier
III	Device Quantifier
TTT	Signal type
III	Signal instance
XXX	Signal Suffix

Document History

Revision	Date	Changed/ reviewed	Modification
1	2010/10/26	G. Trahern	Initial version
1.1	2010/11/16	G. Trahern	Clarify syntax for system/subsystem instantiation TOC formatting
1.2	2011/03/21	G. Trahern	Updated examples, moved reference tables to separate document
1.3	2012/09/26	K. Rathsman	Replaced examples with Implementation-How to name devices
1.4	2013/01/11	K. Rathsman	Updated Implementation and removed references.
2	2013/12/09	K. Rathsman	Update based on naming committee meetings. Conceptually the content is the same, but more explanations and updated examples are given.
2.1	2014/01/17	K.Rathsman	Minor corrections.

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1. Scope

The ESS Naming Convention was agreed upon and approved at an early stage of the ESS project to ensure meaningful, short and yet consistently structured names of signals and devices. Given the millions of signals to control and thousands of devices to operate, clear communication is essential among operators, physicists and engineers. Considerable efforts have been invested to make the ESS Naming Convention useful in a wider context to help enforce system integration activities across all divisions.

The ESS Naming convention applies to all technical systems, devices (beam instrumentation, sensors, actuators, etc.), equipment (power supplies, cables, magnets, RF cavities, targets, moderators, instruments, etc.) and signals. The names shall be used on operator screens, in the inventory system, drawings, design schematics, computer software, project databases, equipment name tags, test procedures, and other sources of technical information at ESS.

The ESS Naming Convention is based on a standard originally developed for the Super Superconducting Collider (SSC) and later adopted by other large research facilities, for example the Spallation Neutron Source (SNS), Facility for Rare Isotope Beams (FRIB), International Thermonuclear Experimental Reactor (ITER), and the Continuous Electron Beam Accelerator Facility (CEBAF). We gratefully acknowledge the use of ideas and nomenclature as well as conversations with personnel from these institutions.

2. Format

2.1. Device Names

From the Integrated Controls Systems (ICS) perspective, all equipment is modelled as a device. Device is the basic unit of ICS granularity, i.e, it is the smallest part that stands alone and is loosely coupled to other parts of the ICS. Device is an abstraction that can represent either single pieces of equipment or higher-level entities of the ICS. Some devices, e.g. a temperature sensor, have only one signal. Others, such as a klystron modulator, contain other devices and even a local control system.

A device name is composed by acronyms and abbreviations, referred to as mnemonic names components described in table 1. It is made up of a system part and a device part separated by a colon and follows the format

SSSS-BBBB:DDDD-III

Each name component shall have a character length of minimum two and maximum six, although recommended length is 3 to 4 characters as indicated by the format.

Devices controlled or monitored by the ICS shall be named according to this format and follow the structure and syntax rules describe in section 3 to 5.

Equipment outside of the ICS scope shall be given a device name if requested. For example, safety valves, like pressure relieve valves, and manual valves are not controlled but should nevertheless be named and also displayed on control screens.

Other equipment, for example light switches in office buildings, can be named according to the convention if required by conventional facilities.

A device can reside inside another device but the parent-child relation may not be resolved from the device names. The hierarchy can instead be found in the configuration database, or from other structures where the device names are used.

Device names shall further not be confused with inventory identification since device names reflect where devices are installed and in which context these are used. In addition, when a device is replaced, the new device inherits the name.

In general, equipment at ESS will be assigned identification codes. Several identification codes will be associated with the equipment represented by each device, in for example work break down structure (WBS), project break down structure (PBS) or other project management systems, inventories as well as the BSAB 96 codes used by conventional facilities. To avoid confusion the device names have to be clearly distinguished from other identification codes of equipment:

1. Equipment identification codes other than device names must not be mnemonic, i.e. it shall not contain abbreviations or acronyms. Having parallel conventions for mnemonic names will inevitably cause confusion.
2. Equipment identification codes other than device names must not simulate the naming convention syntax.

Given the device name it shall be possible to look up the equipment in the inventory or similar systems. Furthermore the device names shall be used in these systems as attributes so that for example device names can be displayed on schematics and drawings.

Names are subject to changes and therefore the name IDs shall be used as reference in all electronic systems using the naming convention.

It is advised to use fixed-width fonts (e.g. Courier) when displaying names.

Table 1: Naming convention components

Mnemonic	Description	Example
SSSS	System	High Beta Linac (HBL) in the Accelerator Water Cooling Plant (WCP)
BBBB	Subsystem	Vacuum (Vac), Water cooling (WtrC)
DDDD	Device Identifier	Beam Loss Monitor (BLM) Gate Valve (GV) Temperature sensor (TSn)
III	Device Quantifier	Numerical and/or alphabetic index to distinguish identical devices of the same system-subsystem.
TTT	Signal type	
III	Signal instance	
XXX	Signal Suffix	

2.2. Signal Names

The signal names, also referred to as Process Variables in EPICS based Control Systems, are constructed by appending the signal components type, instance and suffix to the device names as

SSSS-BBBB:DDDD-III:TTTIIIXXX

All process variable of the integrated control system (ICS) shall be named according this syntax. ICS reserves the right to enforce the naming convention by limiting the functionality of hardware in case the signal names do not follow the convention.

The format of signal names can be used to name parameters, such as length, weight etc. of devices. It is also recommended that device ports are named on this format.

For practical reasons the overall length of a signal name must not exceed 32 characters in total.

3. Naming Structures

The name format in combination with a set of syntax rules do not automatically ensure a meaningful and consistent naming. For example, without a well defined structure and naming rules the system-subsystem part of for example a vacuum pump in the High Beta Linac (HBL) could equally well be named HBL-Vac as Vac-HBL.

To overcome this ambiguity users of the naming convention will be guided by the following two questions during the naming process:

1. What kind of device is it?
2. Which part of the facility does the device provide service to?

The answers, which shall be selected from the device category structure and the logical area structure described below, will be used to generate the names according to the rules in section 4 and 5.

3.1. Logical Area Structure

From the operational point of view it is beneficial to have names mentally linked to physical location. This would help physicists, operators and engineers to orient themselves on the site relative to named technical systems. Devices are therefore sorted under a logical area break down structure in three levels:

Level 1. **Super Section** (SupS): High level area of the facility restricted to a particular use. Example: Target Station (TS), Accelerator (Acc) and Central Services (CS).

Level 2. **Section** (Sect): Accelerator sections correspond to the accelerating structure used along the linac, for example the High Beta Linac (HBL). Sections under Central Services are the Water Cooling Plant (WCP), Cryogenics Plant (CrP) etc.

Level 3. **Subsection** (SubS): Each of the accelerator sections contain devices of several disciplines in a repetitive pattern. Therefore the accelerator subsections are numbered. I.e, the third subsection of HBL is designated 03. The High Beta Water Substation (HBWS) is a subsection under the Water Cooling Plant.

Examples of items in the logical area structure can be found in reference [1].

Conventional facility will use numbers to identify buildings, rooms and sections within. This numbering is independent of the ESS Naming Convention to avoid confusion. The logical area structure is organised after the technical systems, which are likely to be adjusted at a late stage, after the building design has been completed. However, the section mnemonic names Sect or the composed subsection name on the form

Sect-SubS

shall be displayed on building structures wherever required to help personnel to orient themselves relative to the technical systems. This is for example important in the accelerator tunnel along the superconducting part of accelerator, which has a repetitive structure for hundreds of meters.

There is an ongoing process to name system level items of the PBS according the device category structure and the logical area structure. For example, the Water Cooling Plant (WCP) is an item in the PBS as well as a section in the logical area structure, although the structure of the PBS differs from the logical area structure.

Devices shall be sorted under the items in the Logical Area Structure to which these provide service to and not necessarily in the area where the devices are physically located. For example, a high power amplifier provides power to a cavity located in the High Beta Linac (HBL) and shall be named after this section, and not according to its physical location.

Items in the logical area structure are managed by the ESS Naming Committee.

3.2. Device Category Structure

Throughout the facility we can expect to have thousands of different kind of devices. Devices are therefore categorised on three levels in the device category structure:

Level 1. **Discipline** (Dis): Branch of knowledge that indicates the context in which a device is used, such as vacuum (Vac), water cooling (WtrC), proton beam instrumentation (PBI).

Level 2. **Category** (Cat): This level has been introduced to allow certain devices, for example sensors (Sn) to be grouped together in lists. Default category is miscellaneous (Misc).

Level 3. **Generic Device Type** (GDev): Two devices of the same generic type provide the same function. Examples: temperature sensor (TSn), beam loss monitors (BLM), etc.

Examples of the items in the device category structure are listed in reference [2].

Some generic device types, such as pumps, sensors, indicators, are used in multiple disciplines. The generic device types for these shall be named the same but sorted under difference disciplines. For example, a temperature sensor (TSn) is a generic device type in both cryogenics (Cryo) and water cooling (WtrC) disciplines.

Items in the device category structure are managed by the ESS Naming Committee.

3.3. Specific Device Types and Signals

Naming convention users prefer to use generic device type as device identifier DDDD in names. Essential for configuration of the control system is however the specific device type (SDev), which in principle can be viewed as the fourth level in the device category structure:

Level 4. **Specific Device Type** (SDev): Two devices of the same specific device type are identical from a controls perspective and among others have the same set of control signals.

In some cases more than one generic device is assigned as parent to a specific device type. For example, a specific quadrupole type can be designated either as a horizontal (QH) or as a vertical quadrupole (QV).

In difference to the generic device types, which are managed by the naming committee, the specific device types are managed by device editors.

Configuration of a device from the bottom-up approach is initiated by creating a specific device type in the device configuration tool and assigning a parent generic device types from the device category structure. Device editors are allowed to select any suitable and relevant generic device type from level 3 in the device category structure as parent.

Configuration from a top-down approach is initiated by adding instances of devices to the list of named devices and select a specific device types by answering the question “What kind of device is it?”. Although the specific device type are not displayed in names, the naming convention users are responsible for selecting the correct specific device type.

Each specific device type has a set of signals, ports, parameters and other configuration data. The name of these will be used as the signal part TTTIIIXXX of names.

4. Rules on how to Construct Device Names

All information needed to construct device names, except for the quantifier III that makes names unique, are contained in the device category and logical area structures. Names will be constructed differently depending on the section a devices belongs to. This is due to the fact

that target and accelerator, which both are complex systems, are very different. Accelerator sections have many devices of several disciplines in a repetitive pattern while the target, which has considerably fewer devices, has a large fraction of unique equipment. Both divisions agree to use the section names as systems names SSSS and the generic device type as device identifier DDDD. However, as subsystem BBBB the target division uses the subsection name while accelerator division uses the discipline name. As quantifier III the accelerator division uses the subsection number in combination with letters as quantifier.

Therefore, sections are assigned either as the default type (D), which applies to target sections, or as the alternative accelerator-type (A) with different methods to construct names.

System SSSS: Section (Sect) mnemonic name from level 2 in the logical area structure

Subsystem BBBB:

D: Subsection (SubS) mnemonic name from level 3 in the logical area structure

A: Discipline (Dis) convention name from level 1 in device category structure

Device Identifier DDDD: Generic Device Type (GDev) mnemonic name from level 3 in device category structure

Device Quantifier III: The device quantifier shall be used to differentiate device names of the same generic device type (irrespective of discipline) within the same subsection.

D: Instance number/alphabetic index X.

A: Subsection (SubS) mnemonic name from level 3 in the logical area structure, which is a number, immediately followed by an alphabetic instance index X (a, b, c, ..., j).

A single alphabetic character cannot always be used as instance index since some devices like temperature sensors are used in large quantities. Therefore an alternative instance numbering on the form n11, n12, n13, etc is supported. For example, the 12th temperature sensor (TSn) in subsection 7 of the High Beta Linac is named HBL-Cryo:TSn-07n12.

A list of named devices can be found in reference [3].

Having managed to consistently name devices for both target and accelerator we are confident that other parts of the facility can be named using the same underlying structures and tools.

5. General Rules for Names

1. Mnemonic names components for any of the items in the logical area structure (SupS, Sect, SubS) and device category structure, as well as signal part of names, shall be alphanumeric. I.e., only upper and lower case alphanumeric characters (a-z, A-Z, 0-9) are allowed.
2. First character of mnemonic name components for section Sect, D-type subsection SubS, discipline Dis, generic device type GDev and signal part of names TTTIIIXXX as well as instance index X for A-type devices shall be alphabetic.
3. Mnemonic name components for A-type subsection SubS shall be numeric.
4. Mnemonic name components for section Sect and discipline Dis, specific device types SDev as well as device name SSSS-BBBB:DDDD-IIII and signal names shall be unique irrespective of

   (a) Letter case

   (b) Letters `I`, `l` and number `1`

   (c) Letter `O` and number `0`

   (d) Letters `V` and `W`

   (e) Leading zeros, i.e., number `0` immediately following a non-numerical character

5. Mnemonic name components for subsection `SubS` and generic device type `GDev` shall be unique according to rule number 4, however only within the same section and discipline, respectively.

6. Leading zeros shall be used to ensure that all numbers have the same number of digits.

7. Mnemonic name components shall be composed with suitable and logical use of lower and upper case

8. The minimum length of mnemonic name component is two characters.

9. The maximum length of mnemonic name component is six characters.

10. The overall length of a signal name must not exceed 32 characters in total.

6. Tools

Web-based tools are under development to support the process of naming. The following tools are foreseen to support the process of naming.

- **Name Administration Tool**: Tools to administer mnemonic name components in the logical area structure and device category structure. The tool will ensure a set of rules and enforce the syntax rules according to section 5.
- **Device Naming Tool:** Tool to construct and edit instances of device names. To assure integrity of names the naming convention users will be asked to select discipline and device type from device category structure as well as section and subsection from area break down structure. Users should not have to be informed in detail on definitions of section, subsection, discipline or the distinction between generic and specific device types. Neither should they have to keep track of whether a device name is generated as A or D-type.

In addition, the **Device Configuration Tool** will support naming of specific device types and signal parts of names. Example on how these three tools will be uses is described by the workflow in the appendix.

7. References

[1] ESS naming convention reference tables (Section-Subsection)

http://eval.esss.lu.se/cgi-bin/public/DocDB/ShowDocument?docid=41

[2] ESS naming convention reference tables (Discipline-DeviceType)

http://eval.esss.lu.se/cgi-bin/public/DocDB/ShowDocument?docid=42

[3] List of named devices at ESS

http://eval.esss.lu.se/cgi-bin/public/DocDB/ShowDocument?docid=220

Appendix

Roles

There are three roles involved in the naming process. The naming administrator (A) administrates the data and acts on behalf of the naming committee. The device editor (DE) configures devices and is presumably a member of one of the naming sub committees, while the guest (G) is other technical staff. The user privileges are shown in table A.

Table A. Privileges to manage items in the logical area structure and device category structure.

Task	A	DE	G
Browse the name element structures.	yes	yes	yes
Search items in the name element structures.	yes	yes	yes
Browse device and signal list	yes	yes	yes
Search device and signal list	yes	yes	yes
Add items in the logical area structure and device category structures as draft	yes	yes	no
Accept or reject draft items in the logical area and device category structure.	yes	no	no
Propose changes to items in the logical area and device structures	yes	yes	no
Accept or reject proposed changes to items in the logical area and device category structures.	yes	no	no
Mark items to be deleted in the logical area and device category structures.	yes	yes	no
Delete items in logical area and device structures.	yes	no	no
Add new specific device type	yes	yes	no
Edit specific device type owned by the user	yes	yes	no
Edit specific device type not owned the user	yes	no	no
Delete specific device type owned by the user	yes	yes	no
Delete specific device type not owned the user	yes	no	no
Add instances of devices	yes	yes	no
Edit instances of devices owned by the user	yes	yes	no
Edit instances of devices owned not owned the user	yes	no	no
Delete instances of devices owned by the user	yes	yes	no
Delete instances of devices owned not owned the user	yes	no	no

Workflow

This workflow illustrates an example of the naming process.

Alice is an engineer who, for whatever reason, would like to connect a espresso machine to the control system. In this context Alice is our device editor.

1. Browse and search the device category and logical area structures:
   (a) Alice opens the Name administration tool and browses the device category structure to search for a generic device type.
   (b) She looks under the discipline controls (`Ctrl`), but cannot find a generic device type for the espresso machine.
   (c) Maybe there is an espresso machine categorised under a different discipline? Alice enters «espresso» into the search field, but she can still not find a generic device type. She decides to add espresso machine to the list of generic device types.
2. Add a new generic device type (`GDev`):
   (a) Alice selects Controls (`Ctrl`) => Miscellaneous (`Misc`) from the menu list of device categories.
   (b) Alice clicks the add button to add a generic device type under the category Miscellaneous (`Misc`).
   (c) In the field labeled Full Name she enters «Espresso Machine».
   (d) She enters «`EspMch`» in the mnemonic name field. Alice receives a warning since the mnemonic name is longer than the recommended 2-4 character length. Alice ignores the warning. She knows that six characters is allowed.
   (e) Alice adds a comment «Device to prepare espresso.» in the comment field.
   (f) Alice clicks the finish button. As a device editor Alice can only add new generic device types as draft. To make the generic device type active it has to be approved by the name administrator Bob. A notification is sent to Bob about the request for a new generic device type.
3. Configure device from a bottom-up approach:
   (a) Alice uses the device configuration tool to create a new specific device type.
   (b) Alice presses the add button to add a specific device type.
   (c) In the field labeled full name she enters «Specific Espresso Machine».
   (d) Alice adds a comment « coffee yada yada model yada yada please refer to yada yada.» in the comment field.
   (e) She enters «`Alic`» in the mnemonic name fields. The name is neither an acronym nor an abbreviation and therefore not a mnemonic name. Alice knows that specific device names will not be displayed in names so it is up to her to decide.
   (f) Without having to await approval from Bob Alice can select the new generic device type as parent. Alice selects Controls (`Ctrl`) => Miscellaneous (`Misc`) => Espresso Machine (`EspMch`) from the menu.

(g) Alice can continue the configuration by adding parameters, signals and ports to her device but she needs to read the instruction book first and decides to do this later. She finishes by pressing the finish button.

4. Configure device from a top-down approach

   (a) Alice opens up the device naming tool

   (b) She presses the + button to add a new device to the naming database

   (c) Alice selects the device type from the device category list, guided by the question «What kind of device is it?». Alice selects Controls (Ctrl) => Miscellaneous (Misc) => Espresso Machine (EspMch) => Specific Espresso Machine (Alic).

   (d) After having read the leading question «Which part of the facility does the device provide service to?» Alice selects Head Quarter (HQ)=>Integrated Control Centre (ICC)=> Main Control Room (MCR) from the Area breakdown menu list.

   (e) Alice presses the finish button. A naming convention name, with correct quantifier and everything, will be created only after Bob has approved the generic device qualifier.

5. Approve or reject a requested device name

   (a) Bob receives an email that a new generic device name has been added.

   (b) Bob clicks the link in the email which directs him to to the generic device type Espresso Machine (EspMch) in the name administration tool.

   (c) Bob selects the reject radio button.

   (d) Into the message field, which is mandatory if device type is rejected, Bob enters «Use the generic device type Coffee Machine (CoMa) under the Office (Offs) => Miscellaneous (Misc) instead.»

   (e) Bob presses the finish button. A notification is sent to Alice.

6. Edit Specific Device Type

   (a) Alice receives the message from Bob.

   (b) Alice opens the configuration tool.

   (c) From the list of specific device types she presses the edit button of Specific Espresso Machine (Alic).

   (d) She changes the parent generic device to Office (Offs) => Miscellaneous (Misc) => Coffee Machine (CoMa).

   (e) Alice also changes the mnemonic name component to EspMch.

   (f) Alice presses the finish button. The draft naming convention name is updated accordingly and becomes active since the generic device type Coffee Machine (CoMa) already exists.